Title

Using Bi-Weekly Surveys to Portray Adolescent Partnership Dynamics: Lessons From a Mobile Diary Study.

Journal

Journal of research on adolescence : the official journal of the Society for Research on Adolescence, 29(3)

ISSN

1050-8392

Authors

Goldberg, Rachel E
Koffman, Dawn
Tienda, Marta

Publication Date

2019-09-01

DOI

10.1111/jora.12472

Peer reviewed

Using Bi-Weekly Surveys to Portray Adolescent Partnership Dynamics: Lessons from a Mobile Diary Study *

Rachel E. Goldberg,
University of California, Irvine

Dawn A. Koffman,
Princeton University

Marta Tienda,
Princeton University

Abstract
Partnership formation is an important developmental task for adolescents, but cross-sectional and periodic longitudinal studies have lacked the measurement precision to portray partnership stability and flux and to capture the range of adolescent partnership experiences. This article assesses the promises and challenges of using bi-weekly mobile diaries administered over the course of a year to study adolescent partnership dynamics. Descriptive findings illustrate the potential of bi-weekly diaries for both capturing the longitudinal complexity and fluidity of adolescent partnerships as well as for reducing retrospection biases. Results also underscore several challenges, including those posed by missing data, and highlight several strategies for maximizing participant engagement and reliably tracing adolescent partnerships.

Keywords
Adolescent partnerships; diary methods; intensive longitudinal methods

Acknowledgments
This research was supported by funding from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R01HD036916-12S1) and the Spitzer Family Fund for US Health Policy.

* Direct correspondence to Rachel E. Goldberg, University of California, Irvine, 3151 Social Science Plaza, Irvine, CA 92697-5100 (rachel.goldberg@uci.edu).

Using Bi-Weekly Surveys to Portray Adolescent Partnership Dynamics: Lessons from a Mobile Diary Study

Introduction

Intensive longitudinal methods, which involve frequent repeated measurements over time, unlock unprecedented opportunities for capturing developmental processes as they unfold in real-time, for disentangling the causal ordering of events occurring in close temporal proximity, and for decreasing the retrospection biases that often plague survey research (Bolger, Davis, & Rafaeli; 2003; Bolger & Laurenceau, 2013; Shiffman, Stone, & Hufford, 2008). Smartphones have facilitated intensive longitudinal data collection in recent years, given their capacity to prompt and log self-reported responses and to collect passive data (Trull & Ebner-Priemer, 2013). As mobile devices have become ubiquitous among adolescents (Pew Research Center, 2018), the number of studies using intensive longitudinal methods to study their behavioral and emotional dynamics has increased (Wen et al., 2017). Ecological momentary assessment (EMA) studies, which generally involve frequent measurements over relatively short periods, such as a week or a month, have successfully used mobile devices to study variations in adolescents' mood, physical and psychological health symptoms, activity spaces, and risk behaviors (e.g., Browning et al., 2017; DeCarlo Santiago et al., 2016; Hensel & Sorge, 2014; Lippold et al., 2014; Uink, Modecki, & Barber, 2016). However, short windows of frequent measurement are less well-suited for portraying emotional and behavioral

processes that unfold over longer periods, such as the formation, evolution, and dissolution of partnerships.

Partnership formation is a meaningful aspect of normative adolescent development. Adolescent partnerships provide a foundation for adult relationships and are associated with myriad psychosocial and behavioral outcomes that have both short- and long-term consequences, including self-esteem, identity development, school success, and antisocial behaviors (Collins, Welsh, & Furman, 2009; Furman & Collibee, 2014; Furman & Shaffer, 2003). Commonly used cross-sectional and periodic longitudinal surveys (with typical inter-wave intervals of one year or longer) lack the measurement precision needed to capture adolescent partnership dynamics and to assess their consequences (Giordano, 2003; Collins et al., 2009). Youth surveys that rely on retrospection to identify past relationships frequently miss emergent, casual and short-lived partnerships, partly because the early stages of adolescents' romantic involvement are often ambivalent (Carver et al., 2003; Collins et al., 2009). Definitions of partnerships limited to "special" or reciprocated relationships, and surveys that impose caps on the number of past partners reported retrospectively, may also lead to undercounts of adolescent partnerships (Collins et al., 2009). Conversely, social desirability bias may lead to retrospective overestimates of adolescents' partnerships because romantic and sexual partnerships are socially desirable in adolescence (Shwarz & Oyserman, 2001; Nnko et al., 2004).

Snapshot measures from cross-sectional and periodic longitudinal surveys are also ill-suited to portray partnership stability and flux over time (Goldberg & Tienda, 2017; Manning et al., 2014). For example, partnerships recorded as enduring or as dissolved in periodic measurements may actually be "on/off" in nature (Giordano, 2003; Halpern-Meekin et al., 2013). Difficulties retrospectively dating the beginnings of adolescent partnerships also complicate assessments of relationship stability. Carver, Joyner, & Udry (2003) found that over one-quarter of National Longitudinal Study of Adolescent to Adult Health (Add Health) respondents were unable to provide even a year to date the start of their relationships. Capturing stability and flux in adolescent partnerships is important because the developmental consequences of adolescents' partnership experiences may partly depend on their stability. Prior studies based on adults have observed links between relationship instability and both depression (Meadows, McLanahan, & Brooks-Gunn, 2008) and stress (Beck et al., 2010; Halpern-Meekin & Turney, 2016). Furthermore, within-partnership churning has been associated with conflict and intimate partner violence (Halpern-Meekin et al., 2013) as well as general relationship dissatisfaction among young adults (Dailey et al., 2009; Manning et al., 2014). Partly due to the limited temporal precision in adolescent surveys, adolescents' partnership (in)stability has rarely been examined.

Using data from the *mDiary Study of Adolescent Relationships*, this paper assesses the promises and challenges of using bi-weekly mobile

diaries administered over the course of 12 months to study adolescent partnership dynamics. Diary studies, which are “self-report instruments used repeatedly to examine ongoing experiences” (Bolger, Davis, & Rafaeli, 2003: 580), typically administer surveys on a less frequent basis than EMA studies (e.g., once daily or weekly), and over a longer period. They have been fruitfully used to assess recall bias in sexual behavior among adults (Schroder, Carey, & Vanable, 2003). For example, several studies have found that adults tend to report a higher frequency of sexual intercourse retrospectively as compared to prospectively through daily diaries (Gillmore et al., 2010; Huber et al., 2014; Mark et al., 2017; see McAuliffe et al., 2007 for an exception). To our knowledge, diaries have not been used to study adolescent romantic and sexual partnerships. We consider the promises and challenges of the *mDiary* methodology with regard to three aspects of measurement: maximizing longitudinal compliance, detecting partnership stability and flux, and assessing and minimizing retrospection biases among adolescents.

Because prior research indicates that survey response rates and response biases in the reporting of partnerships differ between adolescent girls and boys, where possible we examine variations by gender. In particular, cross-sectional and longitudinal response rates are generally lower among men and adolescent boys than among women and adolescent girls (Chantala, Kalsbeek, & Andraca, 2005; Massey & Tourangeau, 2013). Reflecting gender differences in social norms around sexual behavior,

numerous studies have documented overreports of the number of heterosexual partners from male survey respondents and underreports from female respondents (Nnko et al., 2004; Schroder et al., 2003). Evidence about gender differences in coupling behavior is mixed, however. In some studies, girls were more likely than boys to report being involved in sexual and nonsexual partnerships (Cavanagh, 2007; Giordano, Longmore, & Manning, 2006); nonetheless, there is also evidence that sexual activity outside of a dating relationship is more frequently reported among boys than girls (Manning, Giordano, & Longmore, 2006).

The *mDiary* Study

The *mDiary* study administered bi-weekly surveys over the course of one year to 531 adolescents recruited from a prospective birth cohort study, the Fragile Families and Child Wellbeing Study (FFCWS). The FFCWS has followed a cohort of children born at the turn of the millennium in 20 medium-to-large U.S. cities; births to unmarried mothers were oversampled at baseline (Reichman et al., 2001). The FFCWS surveyed the index children and their families over six waves, most recently when the youth were approximately 15 years of age. *mDiary* sampled adolescents who were interviewed in the most recent FFCWS wave, and whose FFCWS baseline interview was conducted in one of 13 target cities (Baltimore, Boston, Corpus Christi, Indianapolis, Jacksonville, Milwaukee, Nashville, Newark, New York, Norfolk, Philadelphia, Pittsburgh, Richmond, San Antonio, and San Jose);

FFCWS year-15 participants with contact information known to be invalid were excluded from the sampling frame. In nine of the thirteen target cities, *mDiary* sampled 100% of eligible adolescents; adolescents from Newark, Philadelphia, Baltimore, and Richmond were randomly sampled at a rate of 44%. We recruited *mDiary* participants over a 16-month period (January 2016-May 2017) on a rolling cohort basis. Of the 1,343 adolescents selected into *mDiary's* sample, 689 (51%) were located and assented for the study; of these, 77% (531) completed the first diary survey. *mDiary* respondents were eligible to complete 26 surveys over 52 weeks. The final cohort completed eligibility for the last survey in May 2018.

mDiary's methodology was based in part on the methodology used in the Relationship Dynamics and Social Life Study (RDSL) (Barber, Kusunoki, & Gatny, 2011), which was also a diary study that tracked partnerships over time. The RDSL, which focused on unintended pregnancy, administered weekly diaries over a period of 2.5 years to young adult women in Michigan via web and telephone interviews. *mDiary's* methodology differed in target age group, survey mode, survey frequency, sampling frame, and topical focus. The 26 bi-weekly *mDiary* surveys were administered to FFCWS adolescent participants via a mobile-optimized custom web app (mdiary.org) that was linked via an application program interface (API) to the Qualtrics web survey platform. Using questions comparable to those used in other major longitudinal studies of youth, such as the Toledo Adolescent Relationship Study (Manning et al., 2014) and Add Health (Carver et al.,

2003), *mDiary* surveys tracked adolescents' romantic and sexual partnerships with other- or same-sex partners over the course of the year, and recorded the nature of their involvement (e.g., seriousness), partner attributes (e.g., socio-demographic characteristics), and relationship quality (e.g., support, conflict) over time. To assess their dynamic interplay with coupling behaviors, the surveys also traced experiences in other key life domains, such as the family and school.

mDiary promoted participant engagement and persistence in several ways. First, the surveys were kept short: except for the first survey, which included several non-repeating baseline questions and was the first encounter with the *mDiary* survey format, the median completion time for surveys 2-26 was 2.5 minutes. Second, the surveys were administered on a bi-weekly basis rather than more frequently because pilot testing revealed that a two-week interval minimized respondent burden while adequately capturing partnership flux. Third, respondents completed each survey on the device of their choice; the vast majority of surveys (85%) were taken on smartphones. Fourth, participants received several reminders during each survey completion window. Each bi-weekly survey opened on a Sunday and remained open for one week. Up to three automated reminders were sent to respondents via text message and/or email (per respondent preference) over the course of the week. With the exception of Survey 1, which was part of the enrollment protocol and essential for documenting baseline attributes, surveys not completed by the end of the week-long response window were

considered skipped. Finally, to incentivize compliance, respondents received Amazon e-gift cards, disbursed automatically via email or text according to respondent preference. Respondents received a $5 e-gift card for completing the first survey and $2 for each subsequent survey, delivered upon completing three or four consecutive bi-weekly surveys. Upon completing the final survey, respondents received a $10 card.

mDiary also took several steps to capture the full range of partnerships over time and trace partnership stability and flux. First, an expansive definition of partnerships was used. In addition to asking about fully formed partnerships as in other studies, *mDiary* employed terms validated in focus group discussions to inquire about emergent ("talking" or "flirting") partnerships as well as sexual non-romantic partnerships. Second, an innovative application of Qualtrics panel functionality facilitated tracing partnerships over time and permitted customized follow-up questions about particular partnerships. Whenever respondents provided new partner names or initials, that information was stored in a Qualtrics panel file that was accessible to the skip logic of all subsequent surveys. For example, if a respondent indicated they were in a new partnership with JB in survey 3, in survey 4 the initials JB would be pulled from the panel file and the respondent would be asked "In the last survey you mentioned JB. Are you still talking to, flirting with, dating or hooking up with JB?" Respondents who reported a new partner in a given survey were asked whether this was someone they had mentioned in a previous survey; affirmative responses

were followed by a drop-down menu listing partner identifiers. Tracking partnerships in this way avoided unnecessary repetition of responses across surveys; importantly, questions about time-constant characteristics were skipped for previously reported partners.

Finally, *mDiary* assessed and minimized retrospection biases in several ways. First, as noted above, *mDiary* administered surveys on a bi-weekly basis to maintain a relatively short recall window while also minimizing respondent burden. To enable comparisons with estimates derived from the bi-weekly surveys, respondents were asked to recall their number of romantic and sexual partnerships in the last 3, 6, 9, and 12 months.

Key Concepts

Partnership. Partnerships were defined broadly by *mDiary* to capture various types and stages of relationship development. Beginning with Survey 2, respondents were asked in each survey: “Is there someone you are currently talking to, flirting with, dating, or hooking up with?” Adolescents responding in the affirmative were asked to characterize the particular nature of their current partnership.

***Named Partnership*.** To track partnerships across surveys, including the identification of partnerships that ended and later re-emerged, respondents were asked to provide a first name, set of initials, or nickname every time they reported a new partner. Named partnerships possessed such identifiers; unnamed partnerships reflect respondent refusals to provide any identifier.

***Partnership Spell*.** Partnerships may be continuous over time, or they may be "on-again/off-again," reflecting breakups and romantic reconciliations or sexual intimacy with an "ex" (Dailey et al., 2009; Halpern-Meekin et al., 2013). Partnership spells are intervals in which a respondent was continuously partnered with a particular individual. If a partnership ended and then later re-emerged, the portion of the partnership that occurred before the breakup was counted as one spell, and the portion that occurred after the break-up was counted as another.

For relationships that started before first mention of the partner in an *mDiary* survey, the beginning of the first spell may not coincide with the actual start of the partnership. Each time a new partnership was reported, respondents were asked for a categorical estimate of how long they had been talking, flirting, dating, or hooking up with the new partner (*< 1 week*, *1 week or more but less than a month*, *1 month or more but less than 6 months*, *6 months or more but less than a year*, or *1 year or more*). These retrospective reports were not used in assessing the stability of adolescent partnerships because the extent to which these partnerships were stable over the duration preceding the diaries was uncertain.

Promises and Challenges of the *mDiary* Methodology

In what follows, we summarize several insights that illustrate the potential of *mDiary's* approach for maximizing longitudinal compliance, for tracking partnerships and capturing partnership (in)stability, and for

minimizing retrospection biases. We begin by summarizing compliance across the 26 surveys and subsequently illustrate the promise of diary studies for capturing adolescent partnership dynamics and for assessing and minimizing retrospection biases.

Longitudinal Compliance

Overall compliance. During the observation period, the 531 *mDiary* participants completed 9,861 of the 13,806 bi-weekly surveys for which they were eligible—an overall compliance rate of 71.4%. Figure 1 summarizes the proportion of surveys taken among the 531 adolescents who completed the baseline survey. The vertical axis plots the percentage of respondents and the horizontal axis the proportion of *mDiary* surveys taken (out of a possible 26). Overall, 44% of participants took all 26 bi-weekly surveys; for these adolescents, the surveys generated uninterrupted 12-month partnership histories. Almost 65% of adolescents completed at least three-quarters of the surveys, and roughly 70% completed at least half of the surveys. Less than 20% of participants completed fewer than one-fourth of the surveys.

Figure 1 reveals that compliance was much lower among the sub-group designated “reluctant participants” (N=47), namely adolescents who required multiple invitations before completing Survey 1. Assented adolescents who did not complete the first *mDiary* survey in the week-long window allotted were provided four additional week-long response windows to enroll in the study before being removed from the *mDiary* sample. Roughly 45% of reluctant participants completed less than one-fourth of the

surveys, compared to 17% of “on-time” participants (χ^2=20.6, p<0.01). Only 15% of “reluctant participants” completed all 26 surveys, relative to 47% of “on-time” participants (χ^2=17.8, p<0.01). In addition, Figure 1 shows that compliance was higher among female *mDiary* participants than among male participants, particularly in the mid-range of surveys completed. For example, three-fourths of girls completed at least one-half of the diary surveys, compared with 66% of boys (χ^2=5.8, p<0.05).

(Figure 1 About Here)

Variation in compliance. Table 1 disaggregates compliance into measures that distinguish between interim missingness and attrition. Interim missingness entails skipping one or more bi-weekly surveys and subsequently completing one or more later surveys. By contrast, attrition involves skipping a survey and all subsequent surveys. Table 1 indicates that approximately 23% of respondents skipped at least one survey but ultimately completed the final survey, Survey 26. About 19% attrited from *mDiary* before reaching Survey 26 and did not skip any surveys beforehand, and another 14% attrited with some interim missingness prior to permanently ceasing response. Approximately 4% of participants actively requested to withdraw from the study, for reasons that ranged from academic and extracurricular activities (e.g., work, sports) to dissatisfaction with the incentives offered; the remainder who attrited simply ceased responding to surveys.

(Table 1 About Here)

Table 1 illustrates socio-demographic correlates of compliance as well as measures of device type (smartphone usage for Survey 1) and topic salience (ever been in a relationship at Survey 1). Statistically significant differences between respondents completing all 26 surveys and the other compliance sub-groups were assessed using *t*-tests and Pearson's chi-squared tests.

These tests revealed significant gender and socioeconomic variations in longitudinal persistence. Consistent with Figure 1, Table 1 shows higher compliance among female respondents relative to their male counterparts. In particular, girls were more highly represented among the subset of fully compliant respondents (60.3%) compared with adolescents who completed survey 26 with interim missingness (48.3%; $p<0.05$) and adolescents who attrited without interim missingness (50.5%; $p<0.1$).

Socioeconomic comparisons revealed that youth from poor households participated less consistently than their better-off counterparts. For example, 7.7% of respondents who completed all 26 surveys lived in households with incomes at 0-49% of the federal poverty level at the time of the FFCWS baseline survey; this share was 13.3% among adolescents who completed survey 26 with interim missingness ($p<0.1$), 16.5% among adolescents who attrited without interim missingness ($p<0.05$), and 23% among adolescents who attrited with previous skipped surveys ($p<0.05$). Among adolescents who completed all 26 surveys, 42.7% lived in households with income at 300% of the federal poverty level or higher, compared with 29.1% among

adolescents who attrited from *mDiary* with no interim missingness ($p<0.05$) and 24.3% among those who attrited with previous skipped survey ($p<0.05$).

Variations in compliance according to type of device used and prior relationship experience were modest and none of the observed differences attained statistical significance. Overall, 75.1% of adolescents completed their first *mDiary* survey using a smartphone and 73.3% reported having ever been in a relationship at that time.

Capturing Partnership Stability and Flux

Table 2 and Figure 2 illustrate *mDiary* insights into three aspects of partnership stability and flux that may not be precisely measured in conventional longitudinal surveys of adolescents: number of partners, partnership longevity, and within-partnership churning. Table 2 presents descriptive results for these measures of partnership stability and fluidity, stratified by sex. Panel A summarizes respondent-level outcomes, and Panel B provides partnership-level measures. To assess the influence of missing surveys on estimates of partnership stability and flux, Table 2 also presents results for the sub-sample of adolescents who completed all 26 surveys; in addition, Appendix Table 1 displays results for the sub-sample of adolescents who were not fully compliant, and reports tests for differences between participants who completed all 26 surveys (right most panel of Table 2) and those who skipped one or more surveys. Respondents who skipped one or two surveys and reported the same partnership before and after the skipped survey(s) were presumed to have continued the partnership during the

interim period. Partnerships reported before and after three or more skipped surveys (N=16) were excluded from the analyses for lack of information on partnership stability in the interim, although inferences were identical with and without this exclusion.

(Table 2 About Here)

Number of partners. Panel A of Table 2 shows that over two-thirds of *mDiary* participants named at least one ongoing or new partnership over the course of the year-long study. In the full *mDiary* sample, a significantly lower share of girls than boys named no partnerships across the duration of the study (28.3% vs. 37.4%; $p<0.05$). Not surprisingly (given their increased opportunities to report on partnerships), a larger percentage of boys and girls who completed all 26 surveys named at least one partnership (73.5%) relative to those with missed surveys (63.0%) ($p<0.05$; see Appendix Table 1). Gender differences in partnering behavior were not statistically significant for the highly compliant subsample; however, despite gender-based variations in longitudinal compliance, the patterns mimic those of the full sample. Importantly, Table 2 also reveals striking differences between female and male respondents' willingness to provide a partner name: 16.4% of girls refused to provide a partner name at least once, compared to 30.3% of boys ($p<0.01$). Because unnamed partners are not traceable across surveys and it is not possible to distinguish unique unnamed partners from multiple mentions of the same unnamed partner, perforce, the analyses of partnership involvement are restricted to those that are named. At least

some of the observed sex disparities in partnership involvement may, then, reflect differences in male and female respondents' willingness to name partners. Fortunately, more than half of respondents who initially refused to name a partner went on to identify one in a later survey.

Table 2 (Panel A) and Figure 2 also illustrate how diary methods portray movement between partnerships. *mDiary* adolescents who ever named a partner averaged two distinct partnerships over the year-long study period. One partnership was the modal response. However, 17.1% of respondents named three or more distinct partnerships. Panel A in Figure 2 illustrates a partnership history characterized by multiple distinct named partnerships. The X-axis reports the survey number and the Y-axis a unique named partnership number. This adolescent reported four partnerships of durations ranging from 5-8 surveys (10-16 weeks) each.

(Figure 2 About Here)

Respondents also moved between partnership categories over time. Supplementary analyses indicated that dating was the most commonly reported partnership type over the course of the surveys, reported in 64% of *mDiary* surveys in which a partnership type was reported. Talking or flirting was reported in 29% of partnership-surveys, followed by "friends with benefits" in 5% of surveys and a variety of other partnership types in 2% of surveys. At the respondent level, 72% of respondents who named at least one partnership ever reported talking or flirting with a partner, 72% reported ever dating, 24% ever reported friends with benefits, and 16% ever reported

another partnership type. That the percentage of individuals reporting talking or flirting in at least one survey was high at the individual level and much lower at the partnership-survey level suggests that many partnerships evolved quickly from an emergent status to dating or dissolution; a similar dynamic may also have been present for friends with benefits and other partnership types.

Partnership longevity. Panel B of Table 2 illustrates insights *mDiary* can provide with respect to the duration of adolescent partnerships. In the full sample, partnerships averaged 5.9 surveys across spells, implying a mean partnership length of approximately 12 weeks within the 52-week observation window. Table 2 reveals that this average duration was 14 weeks among adolescents who completed all 26 surveys, compared with 9 weeks among respondents with intermittent compliance ($p<0.01$; see Appendix Table 1). Both left- and right-censoring render these estimates of partnership duration conservative, however, because some partnerships were already in progress when first reported by respondents and others were ongoing when last observed in the study. That girls' partnerships spanned more surveys than those of boys (Table 2, Panel B; $p<0.01$) may partly reflect their higher compliance rates and/or their greater willingness to provide partner initials. Of course, summary statistics conceal enormous variation in the duration of teen partnerships because some were very short-lived while others extended throughout the entire study period. Supplementary tabulations revealed that among respondents who completed

all 26 surveys, one-quarter of named partnerships were reported in only one survey, and 8% were reported in every survey.

Within-partnership churning. The partnership durations summarized above are aggregated across spells, and thus may mask another dimension of partnership instability, namely on/off relationships with the same partner. Within-partnership churning can occur due to break-ups and romantic reconciliations and/or sexual activity with a former partner. Panel B of Table 2 shows that on average, 11% of partnerships named by *mDiary* adolescents terminated and were reconstituted in a later survey. The prevalence of churning was similar between fully compliant participants and those who skipped one or more surveys (12% vs. 10%, p=0.83; see Appendix Table 1). The average number of spells per partnership—1.1 on average—implies that the most typical scenarios involved either stable relationships until permanent dissolution or censoring (1 spell), or a single break-up followed by reconciliation (2 spells).

A minority of partnerships were characterized by multiple on and off intervals. Panel B of Figure 2 illustrates an extreme case in which the respondent reported four distinct spells with Partner #1, with breaks of 1-3 surveys between spells. Panel C of Figure 2 illustrates *both* fluidity and stability. The Panel C adolescent named five different partners over the year-long diary study, two of whom (#1 and #4) were reported in only one survey. Partner #3 was first reported for approximately one month (Surveys 4 and 5), and following a brief hiatus with Partner #4, reappeared briefly

until dissolution after Survey 9. A stable partnership with a fifth partner, which commenced in Survey 11, continued through the final survey.

Panel D in Figure 2 demonstrates the challenges posed by attrition and high levels of interim missingness for capturing partnership stability and fluidity over time. Parentheses around a survey number indicate skipped surveys. The adolescent portrayed in Panel D named Partner #1 in Surveys 2 and 4, and partnership status was imputed in Survey 3. After skipping Surveys 5-12, the respondent named Partner #1 again in Surveys 13 and 14, and subsequently attrited. Given the large numbers of consecutive missed surveys, it is impossible to determine whether the relationship with Partner #1 was stable throughout the study, whether churning occurred during skipped survey intervals, and/or whether the partnership dissolved or continued after Survey 14. Fortunately, such extreme cases of missing surveys were rare in *mDiary*; less than 15% of respondents completed fewer than five surveys.

The data summarized in Table 2 and Figure 2 illustrate the partnership complexity that can be captured with bi-weekly surveys. Despite the challenges of missing diary surveys and unnamed partnerships, these results suggest that retrospective accounting of adolescents' coupling may misrepresent both the incidence and stability of partnerships. We consider that possibility next.

Assessing and Minimizing Retrospection Biases

mDiary was also designed to measure and minimize retrospection biases among adolescents. To gauge how much the bi-weekly diaries decreased retrospection biases in partnership counts, we compared aggregated responses from the diaries with responses to a question in the final survey asking respondents to recall their number of partnerships in the last 12 months. The retrospective question asked adolescents to recall only how many girls or boys they had "dated" or "hooked up with" in the past 12 months; therefore, we restricted these analyses to bi-weekly counts of partnerships described as dating or involving any level of sexual activity. We also excluded from these comparisons 177 respondents who did not complete Survey 26 (because the 12-month recall questions were asked only in Survey 26). An additional 105 adolescents who refused to name any partnerships were excluded because of difficulties distinguishing among distinct unnamed partnerships and reports of the same unnamed partner in the bi-weekly reports. In the interest of parsimony, we present comparisons with 12-month recall, which is the most typical retrospection interval in periodic longitudinal surveys. It is noteworthy, however, that similar patterns obtained for shorter retrospection intervals of 3, 6, and 9 months (available upon request).

Figure 3 compares the distributions of responses for 12-month retrospective reports and for aggregated bi-weekly reports, for girls and boys separately. Panel A shows inflated partnership counts in the 12-month retrospective reports relative to prospective counts over the same period,

particularly for boys. In the bi-weekly reports, 79% of boys reported 0 or 1 partnerships, but in retrospective reports, just over half (51.5%) claimed 0 or 1 partnerships.

Another measurement challenge is adolescents' inability to provide any estimate of their number of partners when asked to recall partnerships over a 12-month period. Panel A of Figure 3 shows that 16% of boys and 10% of girls could not remember how many partnerships they had been involved in over the prior 12 months.

(Figure 3 About Here)

For both boys and girls, the distribution for retrospective recall in Panel A had a longer right tail than the distribution of the bi-weekly counts. Appendix Table 2 presents supplementary calculations of within-respondent differences in the number of partnerships reported in 12-month recall and the total number of partnerships reported prospectively over the same period. Specifically, the table shows distributions for deviations between individuals' bi-weekly and annual reports. Appendix Table 2 reveals that nearly two-thirds of adolescents reported the same number of partners retrospectively and prospectively over the 52-week period. Consistent with Figure 3, most deviations from 0 (i.e., non-identical retrospective and prospective reports) involved retrospective overestimates, with boys more likely than girls to inflate their number of romantic or sexual partners over the past year.

The higher counts observed in retrospective estimates could reflect undercounts in the diary reports resulting from missed surveys that were later captured retrospectively. If this were the case, we would expect discrepancies between the bi-weekly and retrospective reports to be smaller for the sub-sample of adolescents who completed all 26 surveys. Panel B of Figure 3 addresses this possibility. Although the discrepancies for 0 partners appear to be attenuated slightly for both girls and boys, the results presented in Panel B are generally very similar to those observed in Panel A. Finally, to consider whether observed discrepancies in prospective and retrospective reports reflect underestimates of concurrent partnerships in the bi-weekly surveys, we calculated the percentage of respondents eligible for the retrospective comparison who also reported any intimate behavior (kissing through sexual intercourse) with someone other than their main partner. Only 1.7% of survey reports provided evidence of concurrent partnerships, suggesting that the incidence of concurrency does not drive the higher partner counts in the retrospective compared with prospective reports.

Discussion

Our findings on longitudinal compliance, partnership stability and flux, and recall illustrate the promises and the challenges of using mobile diaries to study adolescent partnership experiences. Understanding the dynamics of adolescent partnerships is important because research with young adults

suggests that relationship stability and flux are associated with various indicators of well-being, including emotional health and relationship quality (e.g., Halpern-Meekin et al., 2013; Meadows et al., 2008). Yet lack of temporal measurement precision has limited the ability of cross-sectional and periodic longitudinal studies to capture these dynamics to date (Goldberg & Tienda, 2017; Manning et al., 2014). Intensive longitudinal measurement such as that used in *mDiary* permits capturing fluidity and stability in adolescent partnerships and other social domains (Barber et al., 2011; Bolger et al., 2003). Despite these promises, diary studies conducted over protracted periods face challenges that stem from interim missingness, attrition, reactivity, and concurrent partnerships (Barta, Tennen, & Litt, 2012; Black et al., 2012; Schroder et al., 2003). Our focus on compliance, partnership dynamics, and retrospection bias illustrates these challenges while also generating novel insights and lessons for future research.

Comparing *mDiary*'s compliance rate with the rates reported in other intensive longitudinal studies is complicated by several factors, including: a) different survey durations and frequency of prompts; b) variation in data collection modes and incentives schemes; c) different target populations; and d) lack of consistency in reporting response rates for intensive longitudinal studies. Nonetheless, *mDiary's* overall compliance rate of 71.4% was close to the weighted average compliance rate of 78.3% calculated by Wen et al. (2017) based on a meta-analysis of 36 EMA studies implemented with children and adolescents over shorter durations. The RDSL study, which

involved weekly diaries with young adult women over a much longer 2.5-year period, reported a lower overall compliance rate of 45.4% (Barber et al., 2016a).

Observed differences in *mDiary* compliance by SES and gender align with reports from other longitudinal surveys (e.g., Barber et al., 2016a; Chantala et al., 2005; Fitzgerald, 2011). Compared with female respondents, male respondents in our sample had higher levels of interim missingness and attrition, and also were more reluctant to provide identifiers (nickname, initials, or first name) for tracking their partners across surveys. However, comparisons between respondents who completed all 26 surveys and those with less consistent participation revealed that gender differences in partnership formation, stability, and flux were robust to interim missingness and attrition.

mDiary promoted participant engagement and persistence in several ways, including minimizing survey length and frequency, automating reminders, intermittently distributing gift cards, and avoiding repeated requests for time-constant partner characteristics for continuing partnerships. However, future studies might devise alternative ways to further improve compliance by, for example, providing debit cards rather than Amazon gift cards, making more frequent payments (e.g., every two consecutive surveys versus every three or four and/or not penalizing for skipped surveys), and crafting highly customized reminders. Reducing participant burden by further decreasing the frequency of surveys might

yield higher compliance, although researchers should balance this potential gain with the costs of wider reporting intervals for recall precision and for the ability to capture transitions in both partnership status and quality over time. Wen et al. (2017) found that EMA studies with lower sampling frequencies actually had lower compliance rates than studies with higher sampling frequencies. Gender discrepancies in compliance further underscore the importance of devising ways to decrease missing data among adolescent boys; this challenge is not unique to *mDiary*, but rather is shared among longitudinal surveys (e.g., Chantala et al., 2005).

Our innovative use of Qualtrics panel functionality permitted tracking partnerships over time, but our success in doing so partly depended on compliance behavior and partly on respondents' willingness to provide a unique identifier for the partner—initials, nickname or first name. That some participants were initially reluctant to provide partner identifiers weakened our ability to trace emergent partnerships; however, most initially reluctant teens did identify the same or different partners later in the study, possibly indicating increased comfort with the study and/or the partnership over time. Whether and how delayed partner identification introduces biases in the emergence, evolution and dissolution of partnership dynamics among initially reluctant teens requires further scrutiny.

Intermittent missingness and left censoring also posed challenges for our ability to observe partnership dynamics. To minimize loss of partnership data during skipped survey intervals, future studies might devise complex

skip patterns that trigger questions about partnership continuity during skipped intervals. Following up with a sub-set of respondents with high levels of interim missinginess to assess whether and how their partnership histories differed from those of more consistent respondents might also be informative. To address left censoring, and in particular to gather accurate information on the emergence and stability of partnerships ongoing at the time of study start, future research might combine prospective diary reports with baseline retrospective reports that draw on calendar methods designed to improve recall (Luke, Clark, & Zulu, 2011).

These challenges notwithstanding, initial results from the *mDiary* study illustrate the promise of administering mobile-optimized web diaries to yield novel insights about adolescent partnership dynamics and to assess retrospection bias. Consistent with claims that partnership formation is a normative experience in adolescence (Carver et al., 2003; Furman & Shaffer, 2003), the majority of *mDiary* respondents named at least one partnership during the observation period. Some partnerships fizzled quickly while others were stable over several surveys or even the entire year. In line with previous research (e.g., Cavanagh, 2007; Giordano et al., 2006), higher shares of girls than boys reported involvement in partnerships. Although extensive partnership flux was not the modal experience for *mDiary* respondents, almost one-fifth of adolescents who named at least one partner engaged in three or more partnerships over the 12-month window, and approximately one in nine partnerships involved churning.

Reactivity—namely, the possibility that repeated measurement may itself influence behaviors or ratings of experiences—is a challenge confronted by all intensive longitudinal studies (Barta et al., 2012). Repeated measurement can also affect *reports* of behaviors if social desirability bias changes over time (e.g., respondents become more comfortable answering sensitive questions) (Barber et al., 2016b) or if respondents learn skip patterns and subsequently respond in ways that minimize survey duration (e.g., that reporting no partnership will result in a shorter survey). The *mDiary* data collection protocol did not incorporate procedures to test whether completion of bi-weekly surveys altered respondents' attitudes or behaviors. Other diary studies that used such procedures (e.g., Barber et al., 2016b; Halpern, Udry, & Suchindran 1994) found little evidence of panel conditioning. Evidence that respondents experienced changes in partnering behavior over the course of the study might suggest the presence of reactivity. We checked for evidence that reporting on partnerships changed over the course of the *mDiary* study (results available upon request) and found no consistent upward or downward trends, nor consistent upticks or downticks after the quarterly retrospection questions.

We did, however, detect some evidence that *mDiary*'s bi-weekly measurements decreased retrospection biases due to recall error and/or social desirability. Because partnership formation is a socially desirable behavior in adolescence, partnership reports based on recall generally present as overestimates (Luke et al., 2011; Nnko et al., 2004). Temporal

memory decay and “telescoping” can also lead respondents to mistakenly import into the reference period partnerships that actually occurred earlier (Schwarz & Oyserman, 2001). In *mDiary*, retrospective estimates of partners tended toward inflated counts, especially for male respondents, which is consistent with findings from diary studies about adult sexual activity (e.g., Huber et al., 2014; Mark et al., 2017; Schroder et al., 2003). That almost one-fifth of boys could not estimate the number of partners they had over the previous year illustrates the recall problem confronted by conventional longitudinal studies of youth. Robustness checks provided evidence that neither skipped surveys nor partner concurrency accounted for the discrepancies between prospective and retrospective reports of partnerships.

In summary, despite the myriad challenges associated with intensive longitudinal data collection, diary studies hold enormous potential for portraying the emergence and evolution of adolescent partnership trajectories, for precisely measuring the timing and sequencing of partnership events vis-à-vis events in other life domains, and for placing these developmental processes in their larger social and familial contexts over time. We stopped short of characterizing relationship quality or linking partnership dynamics to emotional states or behaviors in this paper. In future research we will use the fine-grained temporal detail in the diary data to examine both the predictors (e.g., family instability, emotional wellbeing) and the consequences (e.g., sexual risk behavior, depression, school engagement) of partnership (in)stability and quality. Emerging methods for

addressing autocorrelated errors, modeling between- and within-subject means and variances, and modeling time-varying effects in intensive longitudinal data make these types of analyses increasingly feasible (Bolger et al., 2003; Bolger & Laurenceau, 2013; Li & Hedeker, 2012; Tan et al., 2012).

References

Barber, J. S., Kusunoki, Y., & Gatny, H. H. (2011). Design and implementation of an online weekly journal to study unintended pregnancies. *Vienna Yearbook of Population Research, 9*, 327-334.

Barber, J. S., Kusunoki, Y., Gatny, H., & Schulz, P. (2016a). Participation in an intensive longitudinal study with weekly web surveys over 2.5 years. *Journal of Medical Internet Research, 18*, 1-12.

Barber, J. S., Gatny, H. H., Kusunoki, Y., & Schulz, P. (2016b). Effects of intensive longitudinal data collection on pregnancy and contraceptive use. *International Journal of Social Research Methodology, 2*, 205-222.

Barta, W., Tennen, H., & Litt, M. D. (2012). Measurement reactivity in diary research. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 108-123). New York: Guilford Press.

Beck, A. N., Cooper, C. E., McLanahan, S. S., & Brooks-Gunn, J. (2010). Partnership transitions and maternal parenting. *Journal of Marriage and Family, 72*, 219-233.

Black, A. C., Harel, O., & Matthews, G. (2012). Techniques for analyzing intensive longitudinal data with missing values. In M. R. Mehl & S. C. Tamlin (Eds.), *Handbook of research methods for studying daily life* (pp. 339-356). New York: Guilford Press.

Bolger, N., Davis, A., & Rafaeli. E. (2003). Diary methods: capturing life as it is lived. *Annual Review of Psychology, 54*(1), 579–616.

Bolger, N., & Laurenceau, J-P. (2013). Intensive longitudinal methods: An introduction to diary and experience sampling research. New York: The Guilford Press.

Browning, C. R., Calder, C. A., Ford, J. L., Boettner, B., Smith, A. L., & Haynie, D. (2017). Understanding racial differences in exposure to violent areas: Integrating survey, smartphone, and administrative data resources. *The Annals of the American Academy of Political & Social Science 669*, 41-62.

Carver, K., Joyner, K., & Udry, J. R. (2003). National estimates of adolescent romantic relationships. In P. Florsheim (Ed.), *Adolescent romantic relations and sexual behavior: Theory, research, and practical implications* (pp. 23–56). Mahwah, N.J: Lawrence Erlbaum Associates, Inc.

Cavanagh, S. E. (2007). The social construction of romantic relationships in adolescence: Examining the role of peer networks, gender, and race. *Sociological Inquiry, 77*, 572-600.

Chantala, K., Kalsbeek, W. D., & Andraca, E. (2005). *Non-response in Wave III of the Add Health Study*. Retrieved from http://www.cpc.unc.edu/projects/addhealth/documentation/guides/copy_of_W3nonres.pdf.

Collins, W. A., Welsh, D. P., & Furman, W. (2009). Adolescent romantic relationships. *Annual Review of Psychology, 60*, 631–52.

Dailey, R. M., Pfiester, A., Jin, B., Beck, G., & Clark, G. (2009). On-again/off-again dating relationships: How are they different from other dating relationships? *Personal Relationships, 16*, 23-47.

DeCarlo Santiago, C., Brewer, S. K., Fuller, A. K., Torres, S. A., Papadakis, J. L., & Ros, A. M. (2016). Stress, coping, and mood among Latino adolescents: A daily diary study. *Journal of Research on Adolescence, 27*, 566-580.

Fitzgerald, J. M. (2011). Attrition in models of intergenerational links using the PSID with extensions to health and to sibling models. *The B.E. Journal of Economic Analysis & Policy, 11*, 1-61.

Furman, W., & Collibee, C. (2014). A matter of timing: Developmental theories of romantic involvement and psychosocial adjustment. *Development and Psychopathology, 26*, 1149-1160.

Furman, W., & Shaffer, L. (2003). The role of romantic relationships in adolescent development. In P. Florsheim (Ed.), *Adolescent romantic relations and sexual behavior: Theory, research, and practical implications* (pp. 3–22). Mahwah, N.J: Lawrence Erlbaum Associates, Inc.

Gillmore, M. R., Leigh, B. C., Hoppe, M. J., & Morrison, D. M. (2010). Comparison of daily and retrospective reports of vaginal sex in heterosexual men and women. *Journal of Sex Research, 47*, 279-284.

Giordano, P. C. (2003). Relationships in adolescence. *Annual Review of Sociology, 29*, 257–81.

Giordano, P. C., Longmore, M. A., & Manning, W. D. (2006). Gender and the meanings of adolescent romantic relationships: A focus on boys. *American Sociological Review, 71*, 260-287.

Goldberg, R. E., & Tienda, M. (2017). Adolescent romantic relationships in the digital age. *Emerging Trends in the Social and Behavioral Sciences,* 1–17.

Halpern, C. T., Udry, J. R., & Suchindran, C. (1994). Effects of repeated questionnaire administration in longitudinal studies of adolescent males' sexual behavior. *Archives of Sexual Behavior, 23*, 41-57.

Halpern-Meekin, S., Manning, W. D., Giordano, P. C., & Longmore, M. A. (2013). Relationship churning in emerging adulthood: On/off relationships and sex with an ex. *Journal of Adolescent Research, 28*(2): 166-188.

Halpern-Meekin, S., & Turney, K. (2016). Relationship churning and parenting stress among mothers and fathers. *Journal of Marriage and Family, 78*, 715-729.

Hensel, D. J., & Sorge, B. H. (2014). Adolescent women's daily academic behaviors, sexual behaviors, and sexually related emotions. *Journal of Adolescent Health, 55*, 845-847.

Huber, L. R., Lyerly, J. E., Young, A. M., Dmochowski, J., Vick, T. M., & Scholes, D. (2014). Comparison of prospective and retrospective measurements of

frequency of sexual intercourse. *Maternal and Child Health Journal, 18*, 1293-1299.

Li, X., & Hedeker, D. (2012). A three-level mixed-effects location scale model with an application to ecological momentary assessment (EMA) data. *Statistics in Medicine, 31*, 3192-3210.

Lippold, M. A., McHale, S. M., Davis, K. D., Almeida, D. M., & King, R. B. (2014). Experiences with parents and youth physical health symptoms and cortisol: A daily diary investigation. *Journal of Research on Adolescence, 26*, 226-240.

Luke, N., Clark, S., & Zulu, E. (2011). The relationship history calendar: Improving the scope and quality of data on youth sexual behavior. *Demography, 48*, 1151-1176.

Manning, W. D., Giordano, P. C., & Longmore, M. A. (2006). Hooking up: The relationship contexts of 'nonrelationship' sex. *Journal of Adolescent Research, 21*, 459-483.

Manning, W. D., Longmore, M. A., Copp, J., & Giordano, P. C. (2014). The complexities of adolescent dating and sexual relationships: Fluidity, meaning(s), and implications for young adults' well-being. In E. S. Lefkowitz & S. A. Vasilenko (Eds.), *Positive and negative outcomes of sexual behaviors. New Directions for Child and Adolescent Development, 144,* 53-69.

Mark, K. P., Smith, R. V., Young, A. M., & Crosby, R. (2017). Comparing 3-month recall to daily reporting of sexual behaviors. *Sexual Transmitted Infections, 93*, 196-201.

Massey, D. S., & Tourangeau, R. (2013). Where do we go from here? Nonresponse and social measurement. *The Annals of the American Academy of Political and Social Science, 645*, 222-236.

McAuliffe, T. L., DiFrancisco, W., & Reed, B. R. (2007). Effects of question format and collection mode on the accuracy of retrospective surveys of health risk behavior: A comparison with daily sexual activity diaries. *Health Psychology*, *26*(1), 60–67.

Meadows, S. O., McLanahan, S. S., & Brooks-Gunn, J. (2008). Stability and change in family structure and maternal health trajectories. *American Sociological Review, 73*, 314-334.

Nnko, S., Boerma, J. T., Urassa, M., Mwaluko, G., & Zaba, B. (2004). Secretive females or swaggering males? An assessment of the quality of sexual partnership reporting in rural Tanzania. *Social Science & Medicine, 59*, 299-310.

Pew Research Center. (2018). Teens, social media, & technology 2018. Washington, DC: Pew.

Reichman, N. E., Teitler, J. O., Garfinkel, I., & McLanahan, S. S. (2001). Fragile Families: Sample and design. *Children and Youth Services Review, 23*, 303-326.

Schroder, K. E. E., Carey, M. P., & Vanable, P. A. (2003). Methodological challenges in research on sexual risk behavior: II. Accuracy of self-reports. *Annals of Behavioral Medicine, 26*, 104-23.

Schwarz, N., & Oyserman, D. (2001). Asking questions about behavior: Cognition, communication, and questionnaire construction. *American Journal of Evaluation, 22*, 127-160.

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology, 4*, 1-32.

Tan, X., Shiyko, M., Li, R., Li, Y., & Dierker, L. (2012). A time-varying effect model for intensive longitudinal data. Psychological Methods, 17*(1),* 61-77.

Trull, T. J., & Ebner-Priemer, U. (2013). Ambulatory assessment. *Annual Review of Clinical Psychology, 9*, 151-176.

Uink, B. N., Modecki, K. L., & Barber, B. L. (2016). Disadvantaged youth report less negative emotion to minor stressors when with peers: An experience sampling study. *International Journal of Behavioral Development, 41*, 41-51.

Wen, C. K. F., Schneider, S., Stone, A. A., & Spruijt-Metz, D. (2017). Compliance with mobile ecological momentary assessment protocols in children and adolescents: A systematic review and meta-analysis. *Journal of Medical Internet Research, 19*, e132.

TABLE 1

Background Characteristics of Analytic Sample by Compliance Subgroups

Means (s.d.) or Percentages

		Compliance Sub-groups			
	Entire mDiary Sample	*Completed all 26 Surveys*	*Completed Survey 26 w/Interim Missing*	*Attrition w/ out Interim Missing*	*Attrition with Interim Missing*
N	531	234	120	103	74
Percentage of *mDiary* Sample	100.0	44.1	22.6	19.4	13.9
Female	55.2	60.3	48.3*	50.5†	56.8
Mean age at *mDiary* Survey 1 [15.8-17.8]	16.7	16.7	16.7	16.7	16.7
(s.d.)	(0.3)	(0.3)	(0.3)	(0.4)	(0.4)
Completed *mDiary* Survey 1 on smartphone (%)	75.1	77.4	70.8	79.6	68.9
Mother's household poverty ratio at FFCWS baseline (%)					
0-49% of the federal poverty level	12.8	7.7	13.3†	16.5*	23.0**
50-99% of the federal poverty level	12.6	12.4	13.3	7.8	18.9
100-199% of the federal poverty level	23.2	21.4	28.3	26.2	16.2
200-299% of the federal poverty level	15.4	15.8	9.2†	20.4	17.6
300% plus of the federal poverty level	36.0	42.7	35.8	29.1*	24.3**
Ever in a relationship at *mDiary* Survey 1 (%)	73.3	70.9	72.5	75.7	78.4

† p <.1, * p <.05, **p<.01.

Notes: Range for continuous variable is given in brackets. Chi-squared tests are used to evaluate the statistical significance of

differences between respondents that completed all 26 survey and each of the other compliance sub-groups for the female, completed Survey 1 on smartphone, mother’s household poverty ratio, and ever in relationship at Survey 1 variables. T-tests are used for mean age at Survey 1.

TABLE 2

Descriptive Statistics on Partnerships from Bi-Weekly Reports
Means (s.d.) or Percentages

	Entire mDiary Sample			*Completed all 26 Surveys*		
Variables	*All*	*Male*	*Female*	*All*	*Male*	*Female*
Panel A: Respondent-Level						
Number named partners (%)						
0	32.4	37.4	28.3*	26.5	30.1	24.1
1	35.0	31.9	37.5	32.9	30.1	34.8
2	15.4	16.0	15.0	18.8	20.4	17.7
3+	17.1	14.7	19.1	21.8	19.4	23.4
Mean # named partners | > 0 [1-8]	2.0	1.9	2.0	2.1	2.0	2.2
(s.d.)	(1.3)	(1.2)	(1.4)	(1.4)	(1.2)	(1.5)
Refused to provide partner name at least once (%)	22.6	30.3	16.4**	23.1	32.3	17.0**
N individuals	531	238	293	234	93	141
Panel B: Partnership-Level						
Mean # surveys partnership reported [1-25]	5.9	5.0	6.5**	7.1	6.1	7.6†
(s.d)	(6.9)	(6.1)	(7.3)	(7.9)	(7.3)	(8.2)
Mean # spells in partnership [1-5]	1.1	1.1	1.1	1.1	1.1	1.1
(s.d)	(0.4)	(0.4)	(0.5)	(0.4)	(0.4)	(0.4)

Partnership ended and then re-started (%)	11.0	10.0	11.7	12.0	10.7	12.8
N partnerships	689	279	410	365	131	234

† p <.1, * p <.05, **p<.01.

Notes: Ranges for continuous variables are given in brackets. Sixteen partnerships reported before and after 3 or more consecutive skipped surveys were excluded from the partnership-level analyses. Chi-squared tests are used to evaluate the statistical significance of differences between male and female respondents for the number of named partners, refused to provide partner name at least once, and partnership ended and then re-started variables. T-tests are used for mean # partners, mean # surveys partnership reported, and mean # spells in partnership.

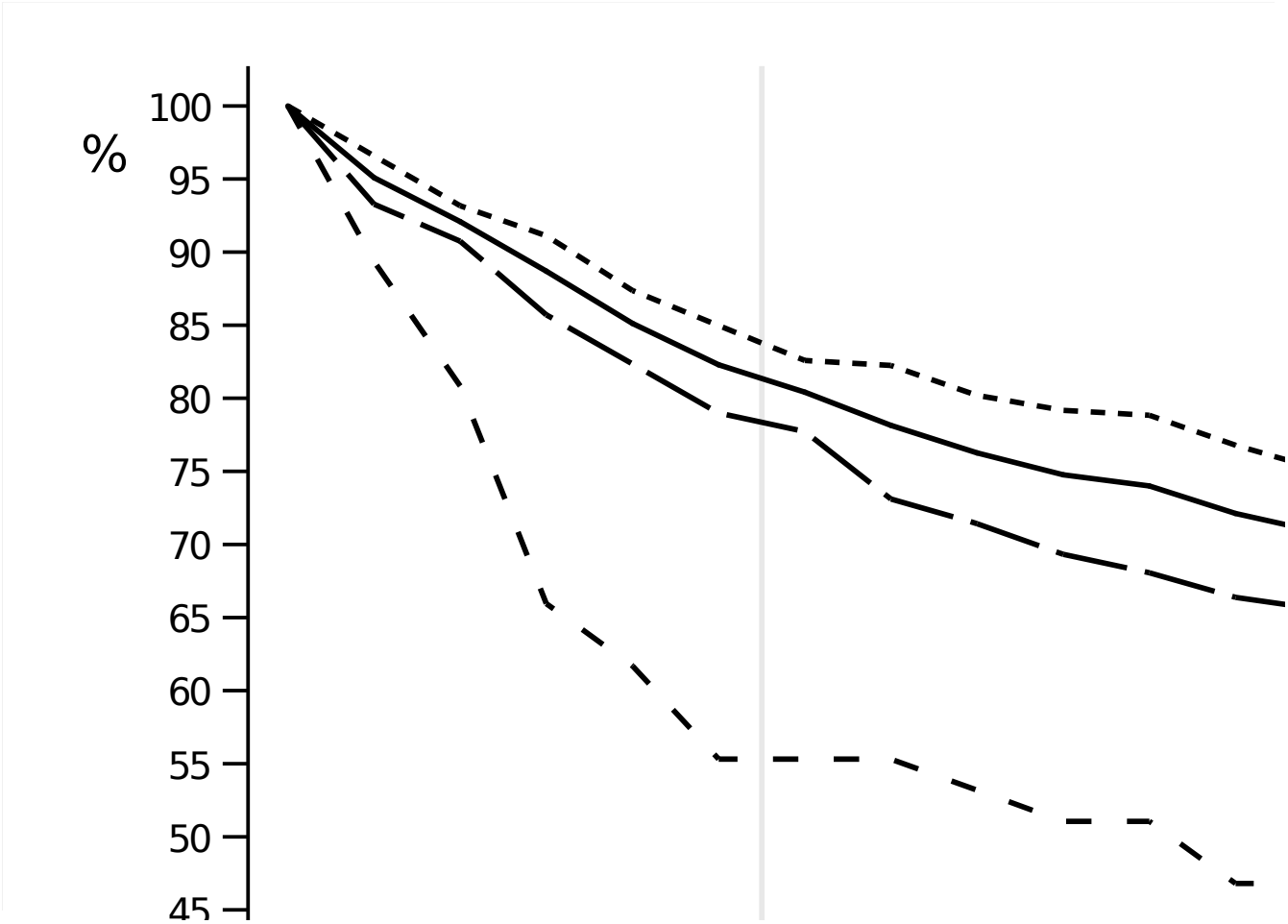
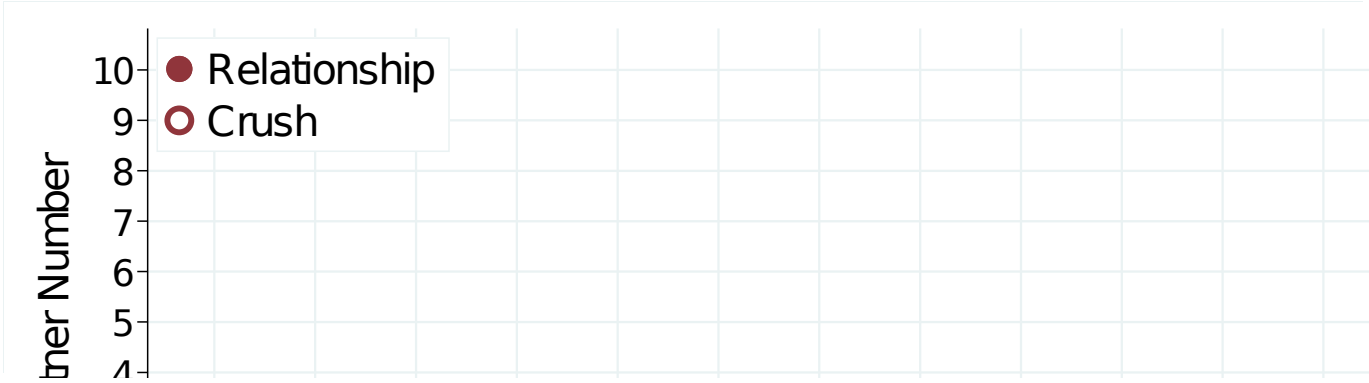
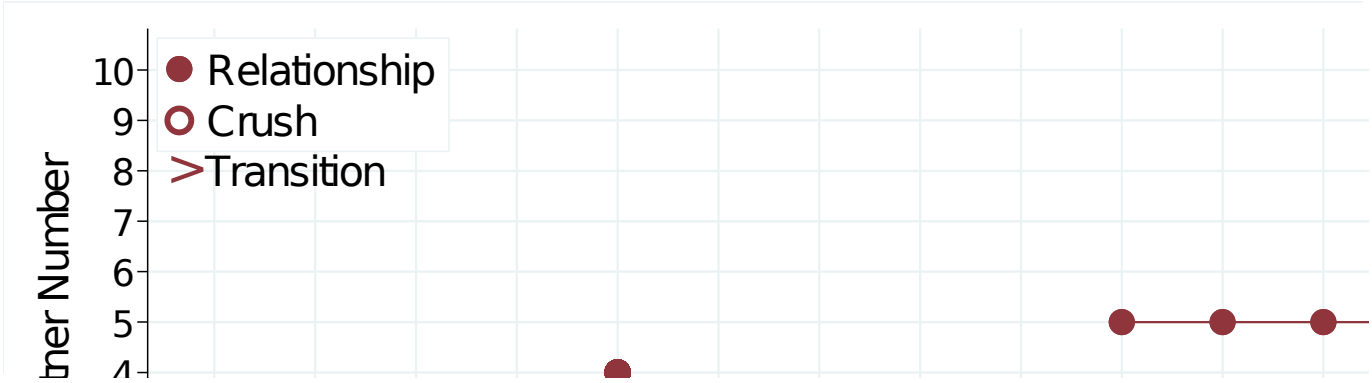


FIGURE 1. Compliance among mDiary participants, by gender and by follow-up required prior to Survey 1 completion. (N=531; Male N=238; Female N=293, Reluctant Participants N=47)

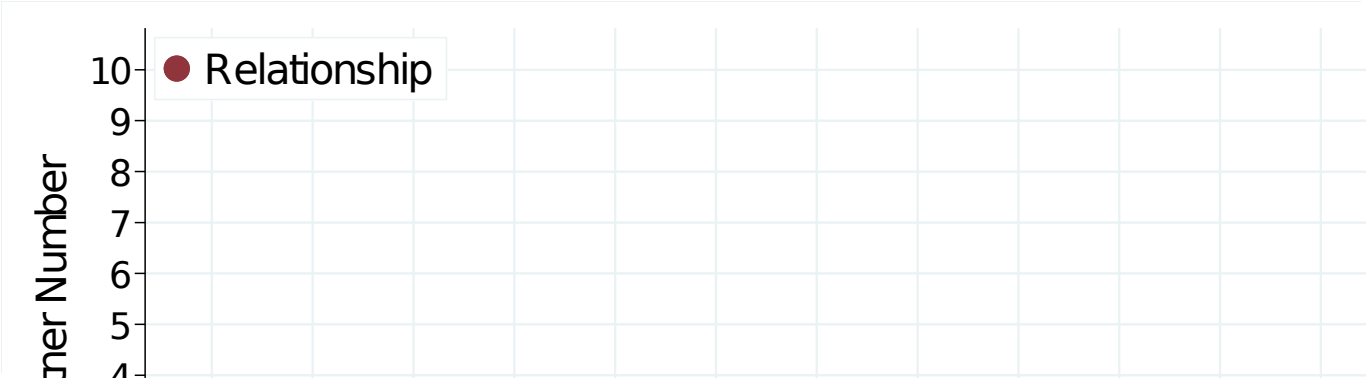


PANEL A: Partnership trajectory illustrating multiple distinct partnerships

PANEL B: Partnership trajectory illustrating within-partnership churning



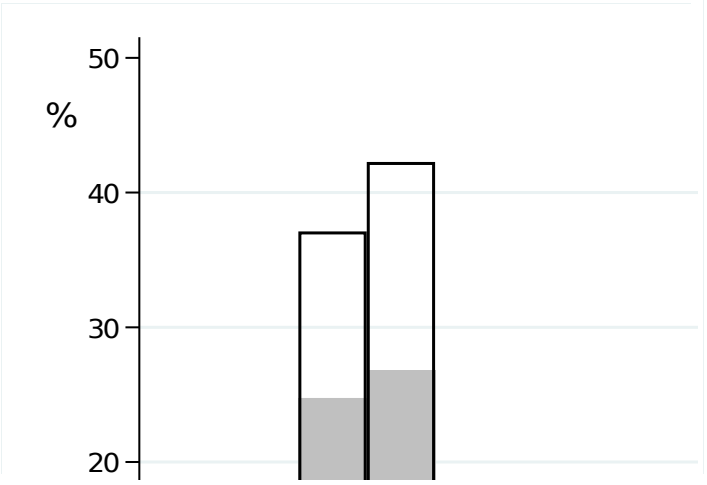
PANEL C: Partnership trajectory illustrating flux and stability



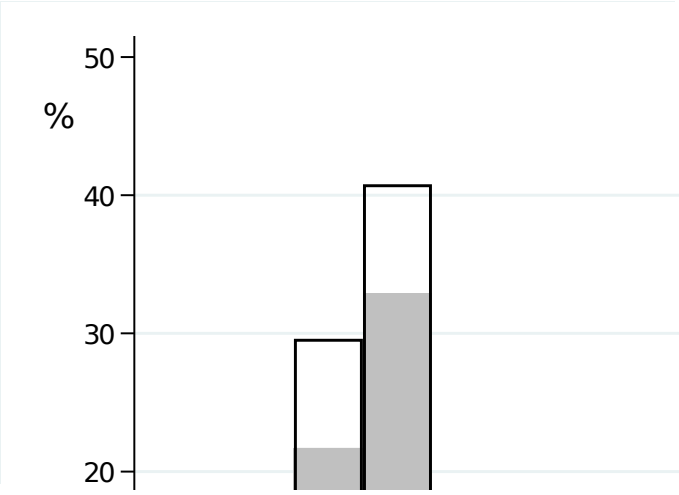
PANEL D: Partnership trajectory illustrating high levels of interim missingness and study attrition

FIGURE 2. Partnership Trajectories Illustrated

Note: Parentheses on horizontal axes denote skipped surveys

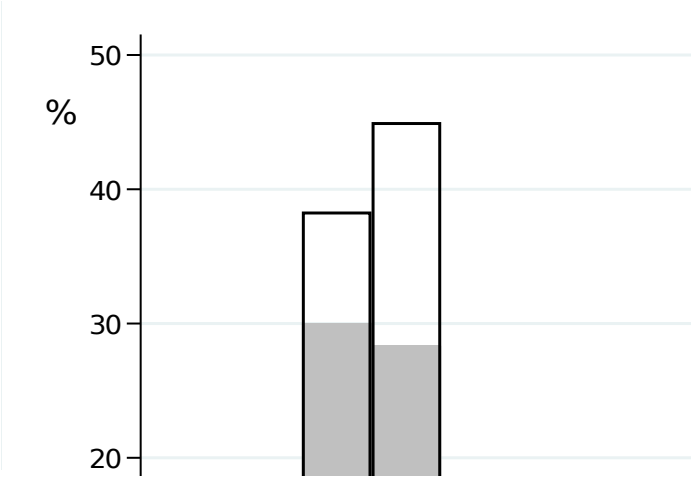


Male respondents who completed survey 26 (N=97)

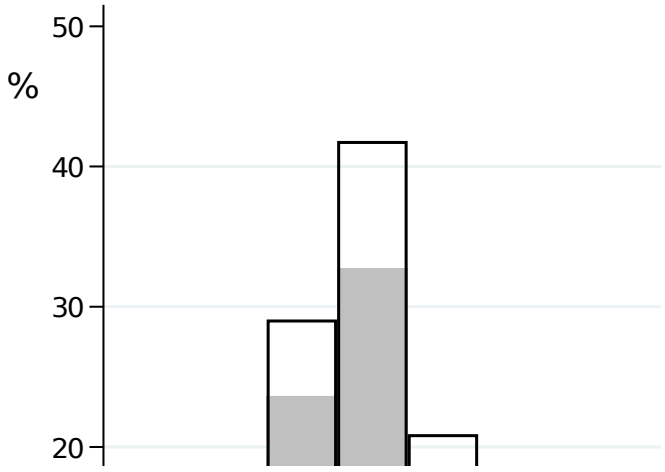


Female respondents who completed survey 26 (N=152)

PANEL A: All respondents who completed survey 26, by sex



Male respondents completing all 26 surveys (N=60)



Female respondents completing all 26 surveys (N=110)

PANEL B*: *Sub-set of respondents who completed all 26 surveys, by sex

FIGURE 3. Comparisons of Bi-weekly Prospective vs. 12-Month Retrospective Reports

Note: Graphs restricted to adolescents who completed Survey 26 and did not refuse to name any partnerships. Ref=refused to respond to survey item.